

AD718752

31 October 1967

Materiel Test Procedure 8-2-190
Dugway Proving Ground

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

TARGET AND AREA SMOKE MARKING MUNITION SUBSYSTEM FOR ARMY AIRCRAFT

1. OBJECTIVE

The objective of this materiel test procedure (MTP) is to outline a series of engineering subtests designed to determine the technical performance and safety aspects of the test item relative to the criteria cited in applicable Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), Technical Characteristics (TC's), and other requirements and documentation that pertain to a particular test item.

2. BACKGROUND

Target and Area Smoke Marking Munition Subsystems for Army Aircraft consist of dispensers and smoke munitions which provide a means of marking targets, drop zones, landing zones, medical pickup sites, and other critical locations. The munitions may be of fuze initiated burning type or of non-burning type which function upon container rupture at impact with resulting filler contact with air. They are designed for use with rotary or fixed-wing aircraft.

To be effective, smoke marking munition subsystems must provide a sufficient time-on-target of white or colored smoke. The munitions must also function in water or jungle canopy.

3. REQUIRED EQUIPMENT

a. Facilities

- 1) Suitable flight test range
- 2) Airfield
- 3) Suitable area or chamber for dissemination of smoke agent
- 4) Environmental test chamber
 - a) Temperature/humidity
 - b) Salt fog
 - c) Rain
 - e) Pressure - Altitude
 - f) Sunshine
 - g) Fungus
 - h) Explosive atmosphere
- 5) Fast burst reactor, linear accelerators, or neutron generators as required

b. Safety Equipment as required

c. Meteorological Equipment

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- 1) Temperature recording equipment
 - 2) Anemometers
 - 3) Humidity recording equipment
- d. Materials Handling Equipment
- e. Photographic Equipment (color and black and white)
- 1) Still
 - 2) Motion picture
- f. Aircraft to be used

4. REFERENCES

- A. Final Report, MK 89 Mod 0 Aircraft Smoke Signals, Operational Procedures for Handling; Evaluation of, 5 October 1966, Naval Air Test Center, Patuxent River, Maryland, AD 800 161
- B. Functional Test of the CBU-22/A Munition on A-1E Aircraft, August 1966, Air Proving Ground Center, Eglin AF Base, Florida, AD 488 174
- C. Production Acceptance Test of the CBU-11/A, CBU-12/A, and CBU-13/A Smoke Munitions, March 1966, APGC-TR 66-15, Air Proving Ground Center, Eglin AF Base, Florida
- D. AMC Pamphlet 706-134, Engineering Design Handbook, Maintainability Guide for Design, February 1966
- E. AMC Pamphlet 706-185, Engineering Design Handbook, Military Pyrotechnics Series, Part One, Theory and Application, April 1967
- F. MIL-STD-810, Environmental Test Methods
- G. MIL-STD-331, Fuze and Fuze Components, Environmental and Performance Tests for
- H. MTP 8-2-500, Receipt Inspection
- I. MTP 8-2-503, Rough Handling and Surface Transport
- J. MTP 7-1-002, Air Portability and Air Drop Service Testing
- K. MTP 8-2-513, Dissemination Characteristics, CB Munitions Dissemination Devices
- L. MTP 8-2-509, Radiography

5. SCOPE

5.1 SUMMARY

The subtests outlined in this MTP provide general procedures for determining the technical performance of the test items. Specific testing requirements and procedures will be dictated by the performance and characteristics criteria for the test item.

The following procedures shall be performed on a selective basis as required to determine if the test item meets the criteria established:

NOTE: Although the details are described in successive paragraphs, it is understood that some steps will not necessarily be

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conducted in the order in which presented, and that some will overlap or may be performed simultaneously.

a. Receipt Inspection - An inspection of the test item, as received, to: (1) determine its physical characteristics and condition; (2) locate any defects it might have; and (3) identify damage received during transport. During this inspection, the test items will also be serialized for subsequent identification purposes.

b. Safety Evaluation - An evaluation of the Safety Statement issued by the developing agency, and to identify the safety hazards, if any which must be included in the Safety Release Recommendation required by USATECOM Regulation 385-6.

c. Simulated Environmental Testing - A study to: (1) provide a basis for estimating the effects of extreme environments (Desert, Tropic, and Arctic) on the test item and (2) determine the effects of fresh water and salt water (salt fog) on the test item.

d. Rough Handling and Surface Transport - A study to determine the effects of rough handling and surface transport on the physical and operational characteristics of the test item.

e. Air Transportability - A study to determine the effects of air transport conditions on the physical and operational characteristics of the test item.

f. Radiography - A study to determine the structural and internal condition of the test item.

g. Installation and Maintenance Aspects - A study to determine the ease of installation and to evaluate the design for maintainability as well as other maintenance aspects.

h. Operational Reliability - The objective of this subtest is to determine if the test item meets specified reliability criteria.

i. Dissemination Characteristics - A study to determine the ability of the test item to provide marking smoke in relation to the established criteria and to evaluate the visibility of the smoke cloud when it is formed.

j. Nuclear Effects - A study to determine the effects nuclear radiation, blast, and heat have on the test item.

k. Susceptibility to Sympathetic Detonation - A study to determine if the test item munition will sympathetically detonate from the force of nearby explosions.

l. Agent/Hardware Compatibility - A study to determine if the munition smoke agent fill and casing have a deleterious effect on each other.

m. Human Factors Aspects - The objective of this subtest is to assess ease of handling and installation of test item.

n. Leak Testing - Study to determine if the test item leaks when subjected to standard leak test conditions.

5.2 LIMITATIONS

None

6. PROCEDURES

6.1 PREPARATION FOR TEST

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6.1.1 Safety Statement, Safety of Flight Release

a. The test officer shall ensure that a Safety Statement has been received from the developing agency and is understood. The Safety Statement includes information pertaining to operational limitations and specific hazards peculiar to the test item.

b. The test officer shall insure that a Safety Release (AMCR 70-33) has been received from U. S. Army Aviation Material Command if required by the test directive or necessary for safety in testing. The Flight Safety Release includes information pertaining to the effect of the installed smoke subsystem on the airworthiness of the aircraft to be used in the test, together with any flight envelope restrictions.

6.1.2 Safety

a. Test and subtest plans and procedures shall ensure performance in the safest manner consistent with accomplishing the mission. The cardinal principle is to limit exposure of a minimum of personnel, for a minimum time, to a minimum amount of hazardous material consistent with safe and efficient operations. Plans shall include safety procedures, precautions, protections, and emergency procedures as necessary. Technical information on the hazards and safety characteristics of the test item as provided by the Safety Statement, Safety of Flight Release and other pertinent information shall be included. Such information shall include evaluation of potential hazards, analysis of risks, limitations, and precautions including special test equipment and techniques that should be incorporated in test plans and procedures.

b. A specific individual shall be charged with responsibility for safety. He shall be knowledgeable of the construction and operation of the test item and its critical components, shall have full knowledge of the hazards and safety aspects of the test, and shall review test procedures for evaluation of hazards and recommend control measures.

c. All personnel who participate in or observe the tests shall be briefed on the hazards involved and proper test methods and procedures.

6.1.3 Security

Security considerations shall be adequately determined and provided for as applicable for each procedure.

6.1.4 Logistical Requirements

Prior to the conduct of the test, the test officer shall ensure that all logistical requirements are satisfied.

6.2 TEST CONDUCT

6.2.1 Receipt Inspection

The test item shall be subject to the applicable procedures of MTP 8-2-500 following its arrival at the test site with emphasis on the following:

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a. Adequacy of packaging - Visually inspect test item package and record the following:

- 1) Binding deficiencies such as broken straps, seals, etc.
- 2) Packaging material deficiencies such as cuts, tears, breaks, etc.

b. Test item inspection:

- 1) Visually inspect the test item for damages such as dents, cracks, illegible markings, bent fins, etc.
- 2) Determine the presence of internal damage to test item as described in the radiography procedures of paragraph 6.2.6.
- 3) Determine the test item's leakage contamination as described in the leakage procedures of paragraph 6.2.14 (if applicable).

c. Determine and record the following:

- 1) Length, width, height and weight of the packaged test item
- 2) Length, maximum height and diameter and weight of the test item

d. Number and identify each test item to be used.
e. Obtain photographs of damaged items.

6.2.2 Safety Evaluation

Determine the test item's safety by performing the following:

NOTE: These procedures shall be used to verify the safety aspects included in the safety statement prepared by the developing agency.

6.2.2.1 40-Foot Drop Test

a. Subject a minimum of 5 test items, with all fuze explosive elements, to the 40-foot drop test of reference 4G (MIL-STD-331) Test 103.
b. At the completion of the drop test, perform the following:

- 1) Record the number of test items that detonate.
- 2) Visually inspect the test items and record any damages or deformation.
- 3) Disassemble the test item (if applicable) and record if any burning or detonation had taken place.
- 4) Photograph damage, deformation and evidence of burning or detonation.

6.2.2.2 5-Foot Drop Test

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- a. Subject a minimum of 10 test items, with all fuze explosive elements, to the 5-foot drop test of reference 4G (MIL-STD-331) Test 111.
- b. At the completion of the drop test, perform the following:
 - 1) Record the number of test items that detonate.
 - 2) Visually inspect the test item and record any damages or deformation.
 - 3) Disassemble the test item, (if applicable) and record if any detonation or burning had taken place.
 - 4) Photograph damage and/or evidence of burning and detonation.

6.2.2.3 Temperature and Humidity Test

- a. Subject a minimum of 20 test items, with all fuze explosive elements, to the temperature and humidity cycle of reference 4G (MIL-STD-331) Test 105.
- b. At the completion of the temperature humidity cycling, perform the following:

- 1) Visually examine the test items and record any deterioration noted.
- 2) Disassemble 1/4 of the test items (if applicable) and visually examine the components. Record all damages and signs of deterioration.
- 3) Subject 1/4 of the test items to the procedures of paragraph 6.2.2.1.
- 4) Subject 1/2 of the test items to the procedures of paragraph 6.2.2.2.

6.2.2.4 Salt Spray Test

- a. Subject a minimum of 20 test items, with all fuze explosive elements, to the 96 hour exposure test of reference 4G (MIL-STD-331) Test 107.
- b. At the completion of the exposure period, perform the following:
 - 1) Visually examine the test items and record any damages noted.
 - 2) Disassemble 1/4 of the test items (if applicable) and visually examine the components. Record all signs of deterioration.
 3. Subject 1/4 of the test items to the procedures of paragraph 6.2.2.1.
 - 4) Subject 1/2 of the test items to the procedures of paragraph 6.2.2.2.

6.2.2.5 Small Arms Penetration

Determine the ability of the test item to resist detonation and/or leakage by means of small arms fire by the following procedures:

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a. Using caliber of ammunition as predetermined and specified in the detailed test plan, subject a minimum of 10 test items, with all fuze explosive elements, as follows:

- 1) Expose five test items, suspended vertically, to small arms fire as specified.
- 2) Expose five test items, suspended horizontally, to small arms fire as specified.

b. Record the following:

- 1) Method of suspension
- 2) Caliber of the small arms
- 3) Firing pattern *
- 4) Number of test items detonated
- 5) Number of the test items subject to leakage

6.2.2.6 Safety Statement Verification

Perform additional checks as required to verify all the safety aspects included in the safety statement recommendation prepared by the developing agency.

6.2.3 Simulated Environmental Testing

6.2.3.1 Extreme Temperature Tests

Unless otherwise directed, the test items shall be subject to the following temperature tests:

6.2.3.1.1 Low Temperature Tests - Place a minimum of 15 test items, which have successfully passed the leak test of paragraph 6.2.14, in a temperature chamber and perform the following:

- a. Reduce the chamber temperature to -80°F (-62.2°C), maintain it at -80°F for a period of 72 hours, and then visually inspect the test item and record any damages.
- b. Raise the chamber temperature to -65°F (-53.9°C) or its minimum operating temperature, and maintain this temperature until stabilization is reached. If stabilization is attained in less than 24 hours, maintain temperature for a complete 24 hour interval. Perform the following:

NOTE: Stabilization, unless otherwise specified, is considered to be reached when the temperature of the test item does not change more than 3.6°F (2.0°C) per hour.

- 1) Visually inspect the test item and record any damages.
- 2) Remove 1/3 of the test items and verify their operability as described in paragraph 6.2.9.

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NOTE: Operability checks should be accomplished within 15 minutes of removing the test items from the chamber.

c. Increase the chamber temperature to local ambient temperature and perform the following:

- 1) Visually inspect the test item and record any damages.
- 2) Subject 1/2 of the test items to the leak test procedures of paragraph 6.2.4.
- 3) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.9.

6.2.3.1.2 High Temperature Tests - Place a minimum of 15 test items, which have successfully passed the leak test of paragraph 6.2.8, in a temperature chamber and perform the following:

a. Adjust the chamber to a temperature of 155°F (88.3°C) and an absolute humidity of 13 grains/ft.³, and maintain these conditions for a minimum of 4 hours, then visually inspect the test items and record any damages.

b. Adjust the chamber to a temperature of 120°F (48.9°C) and a relative humidity of no greater than 15% and maintain these conditions for a minimum of 24 hours and perform the following:

- 1) Visually inspect the test items and record any damages.
- 2) Remove 1/2 of the test items and perform the following:
 - a) Subject 1/2 of the test items to the leak test of paragraph 6.2.14.
 - b) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.9.

c. Adjust the chamber to local ambient temperature and humidity and perform the following:

- 1) Visually inspect the test items and record any damages.
- 2) Subject 1/2 of the test items to the leak test of paragraph 6.2.14.
- 3) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.9.

6.2.3.2 Fungus Test

a. Subject a minimum of 10 test items, with all fuze explosive elements, to the fungi exposure of reference 4F (MIL-STD-810) Method 508.

b. At the completion of the exposure period, perform the following:

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- 1) Disassemble 1/2 of the test items, (if applicable) and record if any fungus was present on the test item components.
- 2) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.9.

6.2.3.3 Humidity Test

- a. Subject a minimum of 10 test items, with all fuze explosive elements, to the humidity cycling of reference 4F (MIL-STD-810) Method 507.
- b. At the completion of the cycling period, perform the following:

- 1) Visually inspect the test items and record any signs of corrosion.
- 2) Disassemble 1/2 of the test items, (if applicable) and inspect the components for corrosion and/or deterioration.
- 3) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.9.

6.2.3.4 Dust Test

- a. Subject a minimum of 10 test items, with all fuze explosive elements, to exposure conditions of reference 4F (MIL-STD-810) Method 510.
- b. At the completion of the exposure period, perform the following:

- 1) Visually inspect the test items and record any surface damages noted.
- 2) Disassemble 1/2 of the test items (if applicable) and inspect the components for damages and/or the presence of dust.
- 3) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.9.

6.2.3.5 Temperature-Altitude Cycling Test

- a. Subject a minimum of 10 test items, with all fuze explosive elements, to the temperature-altitude cycling of reference 4F (MIL-STD-810) Method 504.

b. At the completion of the cycling period, perform the following:

- 1) Subject 1/2 of the test items to the leak test of paragraph 6.2.14.
- 2) Verify the operability of the test items by subjecting the remaining items to the procedures of paragraph 6.2.9.

6.2.3.6 Explosive Atmosphere Test

- a. Prepare a minimum of 15 test items, with all fuze explosive elements, as described in Procedure II of Method 511 of reference 4F (MIL-STD-810).

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b. Subject 1/3 of the test items to steps 1 through 3 of Method 511 at a simulated altitude of 5,000 feet. Record, when applicable, a "main chamber" explosion.

c. Repeat step b at ground level and at 2500 feet.

6.2.3.7 Sunshine Test

a. Subject a minimum of ten test items to the solar radiation exposure of reference 4F (MIL-STD-810) Method 505.

b. At the completion of the exposure period, perform the following:

- 1) Visually inspect the test items and record any surface damage noted.

NOTE: Sunshine causes heating of equipment and fading out of fabric colors, checking of paints, and deterioration of natural rubber and plastics.

- 2) Subject 1/2 of the test items to the leak test procedure of paragraph 6.2.14.
- 3) Verify the operability of the test item by subjecting the remaining test items to the procedures of 6.2.9.

6.2.3.8 Salt Fog Test

a. Subject a minimum of 15 test items, with all fuze explosive elements, to the conditions of Method 509 of reference 4F (MIL-STD-810).

b. At the completion of the salt fog spray exposure, perform the following:

- 1) Rinse the test items with clear water.
- 2) Visually inspect the test items for and record the presence of corrosion.
- 3) Disassemble 1/3 of the test items, (if applicable) and inspect the components for; and record:
 - a) Evidence of water penetration
 - b) Presence of corrosion
- 4) Subject 1/3 of the test items to the leakage test of paragraph 6.2.14.
- 5) Verify the operability of the test items by subjecting the remaining items to the procedures of paragraph 6.2.9.

6.2.3.9 Rain Test

a. Subject a minimum of 15 test items, with all fuze explosive elements, to the rain conditions of Method 6 of reference 4F (MIL-STD-810).

b. At the completion of the rain exposure, perform the following:

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- 1) Visually inspect the test items for, and record the presence of, corrosion.
- 2) Disassemble 1/3 of the test items, (if applicable) and inspect the components for, and record:
 - a) Evidence of water penetration
 - b) Presence of corrosion
- 3) Subject 1/3 of the test items to the leakage test of paragraph 6.2.14.
- 4) Verify the operability of the test items by subjecting the remaining items to the procedures of paragraph 6.2.9.

6.2.3.10 Water Immersion Tests

a. Immerse a minimum of 15 test items, with all fuze explosive elements packaged in their original containers, in water to a predetermined depth.

NOTE: The water depth and temperature, and location of immersion shall be in accordance with applicable criteria and quality control system requirements and stipulated in the test directive.

b. Record the following with the test items immersed:

- 1) Depth of water over container
- 2) Temperature of water
- 3) Presence of bubbling to indicate container leakage
- 4) Immersion time until bubbling occurs
- 5) Total immersion time

c. At the completion of the immersion test, remove the test items from their containers and perform the following:

- 1) Visually inspect the test items for, and record the presence of, corrosion.
- 2) Disassemble 1/3 of the test items, (if applicable) and inspect the components for, and record:
 - a) Evidence of water penetration
 - b) Presence of corrosion
- 3) Subject 1/3 of the test items to the leakage test of paragraph 6.2.14.
- 4) Verify the operability of the test items by subjecting the remaining items to the procedures of paragraph 6.2.9.

6.2.4 Rough Handling and Surface Transport Tests

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6.2.4.1 Handling and Transportation Test

a. Subject a minimum of 10 test items, with all fuze explosive elements packaged in their original containers, to the applicable procedures of MTP 8-2-503.

b. At the completion of testing, perform the following:

- 1) Visually examine the test item's for, and record the presence of cracks, breaks, undone binding, etc.
- 2) Visually examine the test items for, and record the presence of, damages and/or deformations.
- 3) Subject 1/2 of the test items to the following:
 - a) Radiography test of paragraph 6.2.6
 - b) Leak test of paragraph 6.2.14
- 4) Verify the operability of the test item by subjecting the remaining items to the procedures of paragraph 6.2.9.

6.2.4.2 Vibration Test

a. Subject a minimum of 10 test items, with all fuze explosive elements packaged in their original containers, to the procedures of Equipment Category g (Shipment by Common Carrier) of Method 514 of reference 4F (MIL-STD-810).

b. At the completion of testing, repeat the procedures of paragraph 6.2.4.1.b.

6.2.4.3 Shock Test

a. Subject a minimum of 10 test items, with all fuze explosive elements packaged in their original containers, to each applicable Transit Test of Method 516 of reference 4F (MIL-STD-810).

b. At the completion of each transit test performed, repeat the procedures of paragraph 6.2.4.1.b.

6.2.5 Air Transportability

Determine the effects of pressure-altitude and vibration, similar to that which will be experienced by the test item in flight as follows, and the ease of loading/unloading aircraft as follows:

6.2.5.1 Loading/Unloading

NOTE: Background information on air transportability is contained in MTP 7-1-002.

a. Load the test items, in their shipping containers, aboard aircraft, or simulated aircraft facilities as indicated in the test plan loading schedule using normal loading equipment and record the following:

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- 1) Type of aircraft used/simulated
- 2) Shipping container length, width, height, weight and material
- 3) Equipment used for loading
- 4) Difficulties encountered while loading
- 5) Method of tie-down
- 6) Damage incurred to the package while loading

b. Unload the test items from the aircraft/simulated aircraft and record:

- 1) Equipment used in unloading
- 2) Difficulties encountered while unloading

6.2.5.2 Simulated Flight Test

a. Subject a minimum of 10 test items, with all fuze explosive elements in their shipping containers, to the following simulated conditions simultaneously:

- 1) Ambient pressure of the maximum altitude the test item is expected to be flown
- 2) Flight vibration conditions as described in the procedures of Equipment Category g (Shipment by Common Carrier) of Method 514 of reference 4F(MIL-STD-810)

b. At the completion of the simulated pressure-altitude/vibration testing, subject the test items to the procedures of paragraph 6.2.4.1.b.

6.2.6 Radiography

a. Determine the internal and structural condition of the test item, using radiography, as described in the applicable sections of MTP 8-2-509 as directed in the test plan or at following times:

- 1) Upon receipt of the item
- 2) At the conclusion of:
 - a) Rough handling and surface transport tests (paragraph 6.2.4)
 - b) Simulated flight tests (paragraph 6.2.5.2)

b. Record the position of the test item or its components while undergoing radiography tests.

NOTE: The test items position shall be based upon applicable test criteria.

6.2.7 Installation and Maintenance Aspects

6.2.7.1 Installation Aspects

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a. Install and remove the test items from appropriate aircraft a minimum of 10 times in accordance with applicable instructions, manuals, etc., and record the following for each performance and type of aircraft.

- 1) Type of aircraft
- 2) Special tools or skills required
- 3) Ease of installation
- 4) Ease of removal
- 5) Adequacy of instructions
- 6) Mission readiness time (installation)
- 7) Turn-around time
- 8) Any difficulties encountered

b. Photograph the following with a still camera:

- 1) The test item as installed on each appropriate aircraft
- 2) Difficulties/ill-fits deemed appropriate to be supplemented by photographs

6.2.7.2 Maintenance Aspects

NOTE: Background information on checking a test item to determine its maintenance aspects is contained in AMC Pamphlet 706-13⁴

- a. Determine what common type and specialized tools are required to perform maintenance.
- b. Inspect the test item for deficiencies which will require replacement of components before the item can be tested. Photograph all deficiencies.
- c. Accomplish necessary maintenance.
- d. Note whether special tools or skills are required.
- e. Note ease of maintenance.
- f. Note adequacy of maintenance manuals, instructions, etc.

6.2.8 Dissemination Characteristics

- a. Determine the dissemination characteristics of the test item as described in the applicable sections of MTP 8-2-513.
- b. Describe the cloud and dispersion characteristics.
- c. Obtain motion pictures of the testing up through final cloud dispersion.

6.2.9 Operational Reliability

- NOTE: 1. Reliability testing shall be conducted under the conditions prescribed in the test criteria and other applicable instructions, as based upon the requirements contained in the applicable QMR or SDR and TC's.
2. The test item undergoing operational reliability testing shall have previously been subject to the following test procedures:

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- a) Simulated Environmental Testing, Less Explosive Atmosphere (Paragraph 6.2.5)
 - b) Rough Handling (Paragraph 6.2.4)
 - c) Simulated Flight Test (Paragraph 6.2.5.2)
 - d) Nuclear Effects Tests (Paragraph 6.2.10)
3. Locate motion picture cameras and measuring devices, i.e., surveyor transits, in a position relative to the drop zone, so that the cloud formation may be photographed, measured and recorded.
- a. Eject the test items (white and/or colored smoke munitions as applicable) from the right dispenser on the aircraft when it is traveling at normal flying speed over a hard surface, at an altitude of 3000 feet during daylight, in moderate temperature in calm air without precipitation.
 - b. Observe and record the following:
 - 1) Operability of the eject mechanism to ensure test item arrival on target
 - 2) Test item ballistic characteristics
 - 3) Time lapse between fuze activation and detonation, when applicable
 - 4) Operability of the retardation system, when applicable
 - 5) Damage to the test item, due to the drop, if applicable
 - 6) Proper functioning of the test item
 - 7) Duration of smoke emersion and direction of smoke on target
 - 8) Visibility of the smoke from aircraft
- NOTE: Visibility criteria shall be predetermined to serve as a basis for evaluating smoke cloud effectiveness
- 9) Meteorological conditions:
 - a) Temperature gradient
 - b) Wind speed and direction
 - c) Relative humidity
 - 10) Width, height, and stability of the smoke cloud
 - 11) Aircraft type and flight direction
 - 12) Effect of test item ejection on the aircraft flight characteristics
- c. Repeat steps a and b with the test item dispersed from:
- 1) The left dispenser
 - 2) Both dispensers
- d. Repeat steps a through c under turbulent air conditions.
- e. Repeat steps a through d at the following altitudes:

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- 1) 2000 feet
- 2) 1000 feet
- 3) 500 feet
- 4) 300 feet

f. Repeat steps a through e with the aircraft flying at:

- 1) Maximum safe speed
- 2) Minimum safe speed in a clear configuration (flaps and gear up)

g. Repeat steps a and b under conditions of existing fog, mist, or other smoke.

h. Repeat steps a and b over the following terrain:

- 1) Deep snow
- 2) Water

i. Repeat steps a and b over a tall tree canopy and record whether the test item penetrates the tree canopy or has a hang-up in the tree-tops.

j. Repeat steps a through i, if applicable, for all appropriate aircraft.

k. Record the effect on the aircraft flight characteristics during the test item ejection.

l. Recover any munitions which did not function and record the following:

- 1) Percent of munitions which did not function
- 2) Reason for not functioning, if possible

m. Obtain motion pictures of all tests from ejection to final cloud dispersion.

6.2.10 Nuclear Effects

NOTE: Nuclear effects evaluation criteria for the test item shall be in accordance with those set forth in the Applicable Materiel Requirements and Documents for the following:

- a) Neutron Dose (RADS)
- b) Gamma Dose (RADS)
- c) Thermal Exposure (CAL/CM²)
- d) Blast Level (Psi) Duration in Sec

6.2.10.1 Neutron Radiation

a. Expose a minimum of five test items to neutron radiation utilizing neutron generators, linear accelerators, or fast burst reactor (FBR) facilities, as appropriate.

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- NOTE: 1. The FBR is an unreflected and unmodulated critical assembly which consists of a right circular cylinder and four controlling components fabricated from Uranium-molybdenum alloy
2. When operating the FBR unit outdoors, observe the following: The reactor shall be protected by an appropriate shield at a prescribed distance from the core center. The distance is dependent on the size of the reactor.
- b. Operate the appropriate facility as directed in the test plan or the unit's specifications to obtain maximum neutron fluence (Neutrons per square centimeter).
- c. Determine and record, using a counter, the delay required before the test item can be handled safely.
- d. Verify the operability of the test item as described in paragraph 6.2.9 when the items become safe to handle.

6.2.10.2 Gamma Radiation

- a. Expose a minimum of five test items to residual radiation tests using a tube source facility of the type used by the U. S. Army Nuclear Laboratory, Edgewood Arsenal.
- b. Locate the test item and Gamma Dosimeter so that, according to the radioactive source strength, an eight hour exposure is required to give the test item the prescribed total dose it would have received in a particular fallout field.

- NOTE: If the test item is greater than 100 feet from the cesium source, an air attenuation factor must be considered when determining source-test item distance.
- c. At the completion of eight hours exposure, record the accumulated gamma dose on the Gamma Dosimeter.
- d. Verify the operability of the items as described in paragraph 6.2.9.

6.2.10.3 Blast Effects

- a. A minimum of ten (10) test items shall be tested, utilizing a shock tube, to determine its ability to withstand blast and shock effects.
- b. At the completion of the blast and shock period, perform the following:
- 1) Visually examine the test items for damages and/or deformation.
 - 2) Subject 1/2 of each sample to the leakage test of paragraph 6.2.14.
 - 3) Verify the operability of the remaining test items by subjecting them to the procedures described in paragraph 6.2.9.

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6.2.10.4 Thermal Radiation Test

- a. Expose a minimum of ten (10) test items to thermal radiation for the length of time at the number of CALORIES/CM² prescribed in the test item's specifications or stipulated in the test plan.
- b. At the completion of the exposure period, perform the following:
 - 1) Visually inspect the test items for damage and deformation.
 - 2) Subject 1/2 of the test items to the leakage test of paragraph 6.2.14.
 - 3) Verify the operability of the remaining test items as described in paragraph 6.2.9.

6.2.11 Susceptibility to Sympathetic Detonation

- a. Place the test item to be tested around, and adjacent to, the item(s) to be detonated.
- b. Record the following:

- 1) Description of the test site
- 2) Number of test items:
 - a) Being detonated
 - b) Undergoing sympathetic detonating testing
- 3) Identification of the test items:
 - a) Being detonated
 - b) Undergoing sympathetic detonating testing

NOTE: The number of test items detonated and undergoing sympathetic detonating testing shall be specified in the test plan.

- 4) Distance between:
 - a) Detonated test items, if applicable
 - b) Detonated test item(s) and test items undergoing sympathetic detonating testing
 - c) Sympathetic detonated test items
- c. Detonate the center test item(s) and record the following:
 - 1) Time between true detonating and sympathetic detonation(s), if any
 - 2) Number of sympathetic detonations
- d. Obtain high-speed photographs of the detonation(s).

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NOTE: If sympathetic detonations occur in a significant number of test items, as stipulated in the test plan, repeat steps a through c using various ratios of test items detonated/test items sympathetically detonated, and various distances between test items.

6.2.12 Agent/Hardware Compatibility

- a. Remove agent from munition and cross section munition.
- b. Clean any remaining agent from the inner wall of the munition
- c. Inspect inner surface of munition for, and record the presence of corrosion, pitting, rust, peeling paint, or any deleterious effect agent fill may have had on munition wall.
- d. Use microscopic type photography to compare surface of casing of unfilled munition with one which previously contained agent fill. Record fill effects.
- e. Determine purity of agent fill removed from the munition to the deleterious effects of the munition components in agent fill. Compare with initial purity of agent.

6.2.13 Human Factors Aspects

a. During the conduct of the paragraphs, observations shall be made relative to the human factors engineering characteristics of the test item. Observe and record the following:

- 1) Ease of handling
- 2) Ease of installation
- 3) Adequacy and simplicity of instructions
- 4) Special skills required
- 5) Special training required

6.2.14 Leak Testing

Determine if the test item leaks as described in the applicable sections of MTP 8-2-512 at the completion of the following:

- a. Extreme temperature tests (paragraph 6.2.3.1)
- b. Temperature-altitude cycling tests (paragraph 6.2.3.5)
- c. Sunshine Test (paragraph 6.2.3.7)
- d. Salt fog tests (paragraph 6.2.3.8)
- e. Rain tests (paragraph 6.2.3.9)
- f. Water immersion tests (paragraph 6.2.3.10)
- g. Rough handling and surface transportability tests (paragraph 6.2.4)
- h. Simulated flight tests (paragraph 6.2.5.2)
- i. Blast effects tests (paragraph 6.2.11.3)
- j. Thermal radiation tests (paragraph 6.2.11.4)

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6.3 TEST DATA

6.3.1 Receipt Inspection

a. Record the following for each test item:

- 1) Test item identification number
- 2) Receipt inspection data collected as described in the applicable sections of MTP 8-2-500
- 3) Test item description
- 4) Total number of test items inspected
- 5) Leakage data collected as described in paragraph 6.2.14
- 6) Radiography data collected as described in paragraph 6.2.6

b. Retain all photographs.

6.3.2 Safety Evaluation

6.3.2.1 40 Foot Drop Test

a. Record the following for each test item:

- 1) Test item identification number
- 2) Damage or deformation incurred
- 3) Evidence of burning or detonation

b. Retain all photographs.

6.3.2.2 5 Foot Drop Test

a. Record the following for each test item:

- 1) Test item identification number
- 2) Damage or deformation incurred
- 3) Evidence of burning or detonation

b. Retain all photographs.

6.3.2.3 Temperature and Humidity Test

a. Record the following for each test item:

- 1) Test item identification number
- 2) External signs of deterioration
- 3) Evidence of internal damage and/or deterioration
- 4) For test items undergoing 40-foot drop test:
 - a) Damage or deformation incurred
 - b) Evidence of burning or detonation
- 5) For test items undergoing 5 foot drop test:

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- a) Damage or deformation incurred
 - b) Evidence of burning or detonation
- b. Retain all photographs.
- 6.3.2.4 Salt Spray Test**
- a. Record the following for each test item:
 - 1) Test item identification number
 - 2) External signs of deterioration
 - 3) Evidence of internal damage or deterioration
 - 4) For test items undergoing 40 foot drop test:
 - a) Damage or deformation incurred
 - b) Evidence of burning or detonation
 - 5) For test items undergoing 5 foot drop test:
 - a) Damage or deformation incurred
 - b) Evidence of burning or detonation
- b. Retain all photographs.

6.3.2.5 Small Arms Penetration

- a. Record the following for each test item:
 - 1) Test item identification number
 - 2) Method of suspension (vertical, horizontal)
 - 3) Caliber of small arms
 - 4) Firing pattern (vertical, horizontal, etc.)
 - 5) Evidence of detonation
 - 6) Evidence of leakage
- b. Record the following for all test items:
 - 1) Total number of test items detonated
 - 2) Total number of test items leaking

6.3.2.6 Safety Statement Verification

Record the results of checking deficiencies indicated in the Safety Statement and record other safety hazards observed.

6.3.3 Simulated Environmental Tests

6.3.3.1 Extreme Temperature Tests

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6.3.3.1.1 Low Temperature Tests

Record the following for each test item, as applicable:

- a. Test item identification number
- b. For temperature of -80°F:
 - 1) Damages incurred
- c. For temperature of -65°F:
 - 1) Damages incurred
 - 2) Operability data collected as described in paragraph 6.2.9
- d. For ambient temperature:
 - 1) Temperature in °F
 - 2) Test item damage
 - 3) Leakage data collected as described in paragraph 6.2.14
 - 4) Operability data collected as described in paragraph 6.2.9

6.3.3.1.2 High Temperature Tests -

Record the following for each test item, as applicable:

- a. Test item identification number
- b. For temperature of 155°F:
 - 1) Damages incurred
- c. For temperature of 120°F:
 - 1) Damages incurred
 - 2) Leakage data collected as described in paragraph 6.2.14
 - 3) Operability data collected as described in paragraph 6.2.9
- d. For ambient temperature:
 - 1) Temperature in °F
 - 2) Damages incurred
 - 3) Leakage data collected as described in paragraph 6.2.14
 - 4) Operability data collected as described in paragraph 6.2.9

6.3.3.2 Fungus Test

Record the following for each test item:

- a. Test item identification number
- b. Presence of fungus on:
 - 1) Test item
 - 2) Test item components

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c. Operability data collected as described in paragraph 6.2.9

6.3.3.3 Humidity Test

Record the following for each test item:

- a. Test item identification number
- b. Evidence of corrosion on:

- 1) Test item
- 2) Test item components

c. Operability data collected as described in paragraph 6.2.9

6.3.3.4 Dust Test

Record the following for each test item:

- a. Test item identification number
- b. Damage to:

- 1) External surface
- 2) Test item components

c. Presence of dust on test item components

d. Operability data collected as described in paragraph 6.2.9

6.3.3.5 Temperature-Altitude Cycling Test

Record the following for each test item:

- a. Test item identification number
- b. Leakage data collected as described in paragraph 6.2.14
- c. Operability data collected as described in paragraph 6.2.9

6.3.3.6 Explosive Atmosphere Test

Record the following for each test item, as applicable:

- a. Test item identification number
- b. Simulated altitude (5,000 ft., 2500 ft., ground level)
- c. Evidence of ignition
- d. Main chamber explosion, if any

6.3.3.7 Sunshine Test

Record the following:

- a. Test item identification number
- b. Damage to:

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- 1) External surface
- 2) Test item components

c. Operability data collected as described in paragraph 6.2.9

6.3.3.8 Salt Fog Test

Record the following for each test item, as applicable

- a. Test item identification number
- b. Evidence of corrosion:
 - 1) Test item
 - 2) Test item components
- c. Evidence of water penetration
- d. Leakage data collected as described in paragraph 6.2.14
- e. Operability data collected as described in paragraph 6.2.9

6.3.3.9 Rain Test

Record the following for each test item, as applicable:

- a. Test item identification number
- b. Presence of corrosion:
 - 1) Test item
 - 2) Test item components
- c. Evidence of water penetration
- d. Leakage data collected as described in paragraph 6.2.14
- e. Operability data collected as described in paragraph 6.2.9

6.3.3.10 Water Immersion Tests

Record the following for each test item, as applicable:

- a. Test item identification number
- b. During immersion:
 - 1) Depth of water over container, in inches
 - 2) Water temperature, in °F
 - 3) Presence of bubbling, if any
 - 4) Immersion time to bubbling, if any, in minutes
 - 5) Total immersion time, in minutes
- c. For the test item:
 - 1) Presence of corrosion:

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- a) Test item
- b) Test item components
- 2) Presence of water penetration
- 3) Leakage data collected as described in paragraph 6.2.14
- 4) Operability data collected as described in paragraph 6.2.9

6.3.4 Rough Handling and Surface Transport Tests

Record the following for each test item, as applicable:

- a. Test performance (handling and transportation, shock, vibration)
- b. Test item identification number
- c. For test item container:
 - 1) Presence of cracks, breaks, etc.
 - 2) Undone binding, if applicable
- d. Damage and deformation to the test item's exterior
- e. Radiography data collected as described in paragraph 6.2.6
- f. Leakage data collected as described in paragraph 6.2.14
- g. Operability data collected as described in paragraph 6.2.9

6.3.5 Air Transportability

6.3.5.1 Loading/Unloading

Record the following:

- a. Type of aircraft used or simulated
- b. Shipping container:
 - 1) Length, width and height, in inches
 - 2) Weight, in pounds
 - 3) Material
- c. Equipment used in loading
- d. Difficulties encountered while loading
- e. Damage incurred to the package while loading
- f. Equipment used in unloading
- g. Difficulties incurred in unloading

6.3.5.2 Simulated Flight Test

Record the following for each test item, as applicable:

- a. Altitude simulated, in feet
- b. Test item identification number
- c. For test item shipping container:

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- 1) Presence of cracks, breaks, etc.
- 2) Undone binding, if applicable

d. For test item individual package:

- 1) Presence of cracks, breaks, etc.
- 2) Undone binding, if applicable

- e. Damage and deformation to the test item's exterior
- f. Radiography data collected as described in paragraph 6.2.6
- g. Leakage data collected as described in paragraph 6.2.14
- h. Operability data collected as described in paragraph 6.2.9

6.3.6 Radiography

- a. Data shall be collected and recorded as described in the applicable sections of MTP 8-2-509.
- b. Record the position of the test item while undergoing radiography checks.

6.3.7 Installation and Maintenance Aspects

6.3.7.1 Installation Aspects

- a. Record the following for each type of aircraft and performances:
 - 1) Type of aircraft
 - 2) Special tools or skill required
 - 3) Ease of installation
 - 4) Ease of removal
 - 5) Adequacy of instructions
 - 6) Mission readiness time, in minutes
 - 7) Turn-around time, in minutes
 - 8) Difficulties encountered

b. Retain photographs showing:

- 1) Test films installed on each appropriate aircraft
- 2) Difficulties encountered

6.3.7.2 Maintenance Aspects

a. Record the following:

- 1) Special tools required for maintenance
- 2) Special skills required to perform maintenance
- 3) Required maintenance
- 4) Adequacy and clarity of maintenance instructions and manuals
- 5) Ease of maintenance
- 6) Maintenance category

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7) Interchangeability of components

- b. Retain all photographs.

6.3.8 Dissemination Characteristics

- a. Record the following:

- 1) Test item identification number
- 2) Data collected as described in the applicable sections of MTP 8-2-513
- 3) Description of cloud and dispersion characteristics

- b. Retain all motion pictures.

6.3.9 Operational Reliability

- a. Record the following for each test:

- 1) Dispenser(s) used (right, left, both)
- 2) Air conditions (calm, turbulent)
- 3) Impacting surface (hard ground, deep snow, water, tree canopy)
- 4) For the aircraft:
 - a) Type
 - b) Velocity in mph
 - c) Direction of flight
 - d) Altitude in feet
 - e) Ejection effect on the aircraft
- 5) For meteorological conditions:
 - a) Wind speed in mph
 - b) Wind direction
 - c) Temperature gradient in degrees F per 1000 feet
 - d) Relative humidity in percent
- 6) Existing air visibility conditions (clear, fog, mist, smoke)
- 7) Operability of eject mechanism
- 8) Test item ballistic characteristics
- 9) Time lapse between fuze activation and detonation, when applicable, in seconds
- 10) Operation of the retardation system, when applicable
- 11) Damage to the test item due to drop, if applicable
- 12) Tree canopy penetration, if applicable (penetrated, hung-up)
- 13) Proper functioning
- 14) Duration of smoke emmission in minutes
- 15) Duration of smoke on target in minutes
- 16) Visibility of the smoke from aircraft
- 17) Width, height and stability of the smoke cloud

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- b. Retain all motion pictures taken.

6.3.10 Nuclear Effects

6.3.10.1 Neutron Radiation

Record the following for each test item:

- a. Test item identification number
- b. Test location (outdoors, reactor cell)
- c. Distance from the reactor core, in feet, if applicable
- d. Neutron fluence in neutrons per square centimeter
- e. Delay period, in hours
- f. Operability data collected as described in paragraph 6.2.9

6.3.10.2 Gamma Radiation

Record the following for each test item:

- a. Test item identification number
- b. Distance between the test item and source, in feet
- c. Source radiation, in rads/hr.
- d. Accumulative test item gamma dose, in rads/hr.
- e. Operability data collected as described in paragraph 6.2.9

6.3.10.3 Blast Effects

Record the following for each test item, as applicable:

- a. Test item identification number
- b. Blast pressure, in psi
- c. Pressure duration, in seconds
- d. Damage and/or deformation incurred, if any
- e. Leakage data collected as described in paragraph 6.2.14
- f. Operability data collected as described in paragraph 6.2.9

6.3.10.4 Thermal Radiation Test

Record the following for each test item, as applicable:

- a. Test item identification number
- b. Time of exposure, in minutes
- c. Thermal radiation, in cal/cm² per minute
- d. Damage and/or deformation incurred, if any
- e. Leakage data collected as described in paragraph 6.2.14
- f. Operability data collected as described in paragraph 6.2.9

6.3.11 Susceptibility to Sympathetic Detonation

Record the following:

- a. Description of the test site

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b. Number of test items:

- 1) Being detonated
- 2) Undergoing sympathetic detonation tests

c. Test item identification number for:

- 1) Test item being detonated
- 2) Test items undergoing sympathetic detonation tests

d. Distance between, in feet, as applicable

- 1) Detonated test items
- 2) Detonated test items and test items undergoing sympathetic detonation tests
- 3) Sympathetic detonated test items

e. Time between fire detonation and sympathetic detonation, in seconds, if applicable

f. Number of sympathetic detonations

6.3.12 Agent/Hardware Compatibility

a. Record the following for each test item:

- 1) Test item identification number
- 2) Presence of the following on the test item inner surface:
 - a) Corrosion
 - b) Pitting
 - c) Rust
 - d) Peeling paint
 - e) Deleterious effect of agent fill
- 3) Effects of fill on casing surface
- 4) Effects of test item components on agent fill

b. Retain all photographs.

c. Retain all laboratory analysis.

6.3.13 Human Factors Aspects

Record the following:

- a. Ease of handling
- b. Ease of installation
- c. Adequacy and simplicity of instructions
- d. Special skills required
- e. Special training required

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6.3.14 Leak Testing

Data shall be collected and recorded as described in the applicable sections of MTP 8-2-512.

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Receipt Inspection

- a. Data collected as a result of this procedure shall be presented as indicated in applicable portions of MTP 8-2-500.
- b. The description of the item, number of items tested, and conditions upon receipt shall be presented in tabular form.
- c. Results of the leak subtest shall be presented in convenient form.
- d. Photographs and X-ray pictures shall be used to substantiate results.

6.4.2 Safety Evaluation

- a. A Safety Release Recommendation (reference USATECOM Regulation 385-6) shall be forwarded to U. S. Army Test and Evaluation Command within 30 days of the beginning of the test. The Safety Release Recommendation shall contain the following information: special safety considerations on hazards to personnel and materiel (including developmental types of equipment as well as standard components used in assemblage of items being tested).
- b. Data and comments relative to safety hazards observed during any phase of testing.
- c. Comments relative to suggested safety improvements.

6.4.3 Simulated Environmental Testing

- a. The results of the subtests conducted shall be presented in tabular or other suitable form.
- b. The results of the operational check tests performed at the conclusion of the various environmental tests shall be presented in narrative or other suitable form.

6.4.4 Rough Handling and Surface Transport

- a. The results of this subtest shall be presented as indicated in applicable portions of MTP 8-2-503.
- b. Tables photographs, narrative comments, or other suitable means of presentation shall be used to report the results.

6.4.5 Air Transportability

- a. The results of this subtest shall be presented as prescribed in MTP 7-1-002.
- b. Air transport conditions shall be reported in tabular or other convenient form.
- c. Narrative comments, photos, etc., may be included, if required.

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6.4.6 Radiography

- a. The results of this subtest shall be presented as prescribed in MTP 8-2-509.
- b. X-ray photographs, supplemented by narrative explanations shall be included as required.

6.4.7 Installation and Maintenance Aspects

Results of this subtest shall be presented in convenient form. Tables, photographs, and other suitable forms of presentation shall be included as required.

6.4.8 Dissemination Characteristics

- a. Results of this subtest shall be presented as prescribed in MTP 8-2-513.
- b. Drawings, tables, charts, photographs or other means of presentation shall be included to report sampling techniques, sampling results, results on test animals, etc.
- c. Narrative comments shall be included as required.

6.4.9 Operational Reliability

Data collected in accordance with paragraph 6.3.9 shall be submitted to a qualified reliability analyst for evaluation. Evaluation shall be presented in narrative form, supplemented by drawings, photographs, charts, tables, graphs, or any other suitable means of displaying information. The report shall clearly conclude whether the test item meets the reliability criteria established in applicable specifications. Recommendations relative to further testing and methods to overcome malfunctions shall also be included.

6.4.10 Nuclear Effects

Data obtained as a result of this subtest shall be reduced and analyzed as required. It shall be presented in the prescribed form, using tables, charts, graphs, pictures, and narrative comments as applicable.

6.4.11 Susceptibility to Sympathetic Detonation

Data from this subtest shall be presented in narrative form supplemented by plots, graphs, and photographs as required to indicate whether test items are subject to sympathetic detonation, and, if so, under what conditions. Significant explosion delay times and other information shall be explained as required.

6.4.12 Agent/Hardware Compatibility

Data from this subtest shall be presented in narrative form and shall clearly indicate whether a particular agent has an effect on the test item or

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its components or vice versa. The report shall be supplemented by photographs, drawings, or other devices required to support the conclusions.

6.4.13 Human Factors Aspects

Data derived from the consideration of human factors shall be reduced and analyzed. It shall be presented in the prescribed form, using tables, charts, photographs, and other means of presentation as required.

6.4.14 Leak Testing

- a. Results of leak testing shall be reported in tabular or other suitable form.
- b. Narrative comments, photos, etc., shall be included as required.